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Subject: SNCR Report / NOxOUT A Consumption AUGUST
Date: Tuesday, September 26, 2006 3:53:48 PM
Attachments: SNCR monthly report.xls

The SNCR system ran 722 hours in August and consumed 29,068 lbs urea solution. There were no deliveries in August. Costs details are reported as attached and compared to June and July.

In August, using the latest ammonia slip measurement from the stack test on August 8 (11 ppm dry basis, 14.7 ppm wet), there was good balance between NH3_{in} and NH3_{out} plus NH3 reacted with NOX.

The process shall be tuned up -- the best opportunity is in improving the furnace and calciner temperature control. Fuel Tech instrumentation shows the urea consumption spiking at high furnace temperatures.

Note the percentage NOx reduction achieved by SNCR in August -- again did not meet quite design. It was 34% versus 35% design.

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UREA NOXout A Monthly Report

Coal Stoker Furnace SNCR
for Calciners CA-1 and CA-2

Process Name: NOxOUT A
Reagent: Urea

Note: Monthly and annual numbers assume 85% onstream

8/7/2006

SNCR startup date CA-2: 6/13/06

	Actual	Actual	Actual	vs Design
	June, 2006 CA-2	July, 2006 CA-2	August, 2006 CA-2	Fuel Tech Proposal & Calcinator 080105
	Typical or Est Measured	Typical or Est Measured	Typical or Est Measured	Design
days	30	31	31	
PROCESS				
Calciner Ore Feed Rate, tORE/h	115	99	114	140
Furnace Heat Load MM Btu/Hr	133	128	141	155
Furnace Outlet Temp deg F	1680	1680	1690	1718
non-SNCR controlled NOX, lb/MM Btu	0.39	0.41	0.41	0.45
non-SNCR controlled NOX, lb/hr	51.9	52.6	57.8	69.8
non-SNCR controlled ppm NOX				231
non-SNCR controlled NOx, tNOX/y	193	196	215	260
SNCR controlled NOX, lb/MM Btu	0.250	0.270	0.270	0.293
SNCR controlled NOX, lb/hr	33.3	34.6	38.0	45.3
SNCR controlled NOx, tNOX/y	124	129	142	169
SNCR NOX reduction, %	35.9	34.1	34.1	35.0
NOX reduction tNOX/y	69	67	73	91
Nox - Urea - NH3 Balance Check				
Ammonia slip, ppm, furnace outlet				15.0
Ammonia slip, ppm, stack outlet	2.5	2.5	14.7	14.9
Ammonia Slip, % of urea consumption	3.1	2.5	19.9	6.9
In				
Urea feed, pure urea, lb/hr	20.8	24.4	20.1	65.6
Converted to NH3, lb/hr	11.8	13.8	11.4	37.2
Total NH3 in, lb/hr	11.8	13.8	11.4	37.2
Out				
Ammonia Slip, lb/hr	0.6	0.6	4.0	4.5
Ammonia reacted w / NO, lb/hr	7.0	6.8	7.5	9.2
Total NH3 out, lb/hr	7.7	7.4	11.5	13.8
Nox - Urea Balance Check -- Forget about Slip				
In				
Urea feed, pure urea, lb/hr	20.8	24.4	20.1	65.6
Total Urea in, lb/hr	20.8	24.4	20.1	65.6
Out				
Urea reacted w / NO, lb/hr	18.6	18.0	19.7	24.4
Total Urea out, lb/hr	18.6	18.0	19.7	24.4
UREA USAGE				
Urea sol'n consumption, lbUREA/month	11,622	32,897	29,068	81,413
SNCR hours of operation / month	280	674	722	621
Urea consumption, lb/h	42	49	40	131
Urea consumption, gal/h	4.4	5.1	4.2	13.8
Urea consumption, gal/y, annualized	32,499	38,215	31,522	102,755
Urea cost, \$/gal delivered	1.52	1.52	1.52	1.49
COSTS				
Urea cost, \$/lb solution delivered	0.16	0.16	0.16	0.157
Urea cost, \$/ton solution delivered	319.74	319.74	319.74	313.43
Urea cost, \$/month	1,858	5,259	4,647	12,759
Urea cost, \$/tORE	0.06	0.08	0.06	0.15
Urea cost, \$/ton Nox removed	713	869	652	1,685
Furnace CO limit, ppm	na	na	na	500
Furnace Exhaust, lb/hr	258,913	249,724	274,300	301,741
Furnace Exhaust, ACFM	309,832	298,835	328,244	361,082
Stack Exhaust, lb/hr	257,517	248,377	272,821	300,114
Pure urea consumption, lb/hr	20.75	24.40	20.13	65.60
lb NH3 required / lb NO				
lb/hr NH3 required in "complete" reaction				
NOX reduction lb/hr	18.6	18.0	19.7	24.4

Urea cost, \$/year per calciner	49,398	58,087	47,914	153,105
Urea composition %	50.0	50.0	50.0	50.0
Urea spec gravity	1.14	1.14	1.14	1.14
Urea lb/gal	9.51	9.51	9.51	9.51

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Stoichiometry

MOLECULAR WEIGHTS

Na2CO3-NaHCO3-2H2O	226.03	226.03	226.03	226.03
Na2CO3	105.99	105.99	105.99	105.99
H2O	18.02	18.02	18.02	18.02
CO2	44.01	44.01	44.01	44.01
C	12.01	12.01	12.01	12.01
Air	28.85	28.85	28.85	28.85
N2	28.01	28.01	28.01	28.01
O2	32.00	32.00	32.00	32.00
H2	2.02	2.02	2.02	2.02
Na	22.99	22.99	22.99	22.99
S	32.64	32.64	32.64	32.64
SO2	64.64	64.64	64.64	64.64
NH3	17.035	17.035	17.035	17.035
NO	30.01	30.01	30.01	30.01
CO(NH2)2	60.06	60.06	60.06	60.06

CO(NH2)2 + H2O	78.08	78.08	78.08	78.08
2NH3 + CO2	78.08	78.08	78.08	78.08

so.....CO(NH2)2 lbUREA	60.06	60.06	60.06	60.06	lbs urea will produce
makes this many lbAMMONIA (2NH3)	34.07	34.07	34.07	34.07	lbs ammonia

4NH3 + 6NO	248.17	248.17	248.17	248.17
5N2 + 6H2O	248.17	248.17	248.17	248.17

and this many lbsAMMONIA (4NH3)	68.14	68.14	68.14	68.14	lbs NH3 will consume
will consume this many lbsNOX (6NO)	180.03	180.03	180.03	180.03	lbs NO

Alternate (John Boyle, Fuel Tech)

NH2-CO-NH2 (Urea) + 2 NO + ½ O2	136.07	136.07	136.07	136.07
2 N2 + 2 H2O + CO2	136.07	136.07	136.07	136.07

so.....CO(NH2)2 lbUREA	60.06	60.06	60.06	60.06	lbs urea will consume
will consume this many lbsNOX (2NO)	60.01	60.01	60.01	60.01	lbs NO